1.5A, 1.4MHZ HIGH EFFICIENCY SYNCHRONOUS DC-DC BUCK CONVERTER

Description

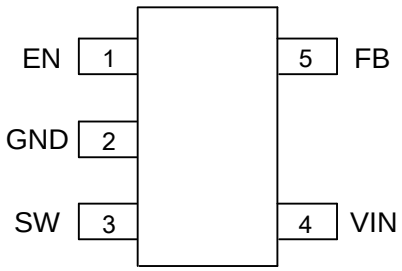
The AP3418 is a 1.4MHz fixed frequency, current mode, PWM synchronous buck (step-down) DC-DC converter, capable of driving a 1.5A load with high efficiency, excellent line and load regulation. The device integrates synchronous P-channel and N-channel power MOSFET switches with low on-resistance. It is ideal for powering portable equipment that runs from a single Li-ion battery.

A standard series of inductors are available from several different manufacturers optimized for use with the AP3418. This feature greatly simplifies the design of switch-mode power supplies.

The AP3418 is available in SOT25 package.

Pin Assignments

(Top View)



SOT25

Features

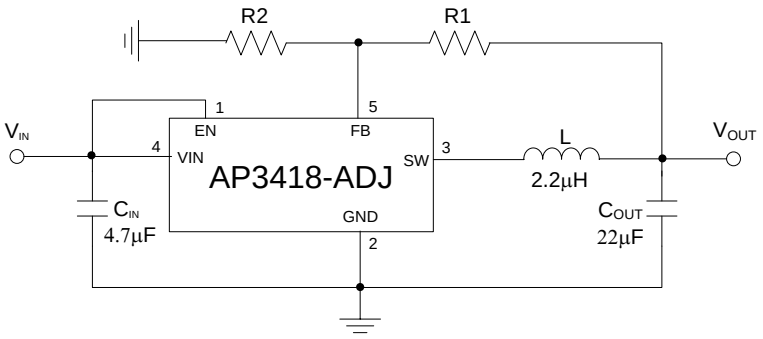
- Input Voltage Range: 2.5V to 5.5V
- Output Voltage: 0.6V to V_{IN}
- ADJ Output
- Fixed 1.4MHz Frequency
- High Efficiency up to 95%
- Output Current: 1.5A
- Current Mode Control
- 100% Duty Cycle in Dropout
- Built-in Over Current Protection
- Built-in Short Circuit Protection
- Built-in Thermal Shutdown Protection
- Built-in UVLO Function
- Built-in Soft-start
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

- LCD TV
- Set-top Box
- Datacom
- Portable Device
- Smart Phone

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

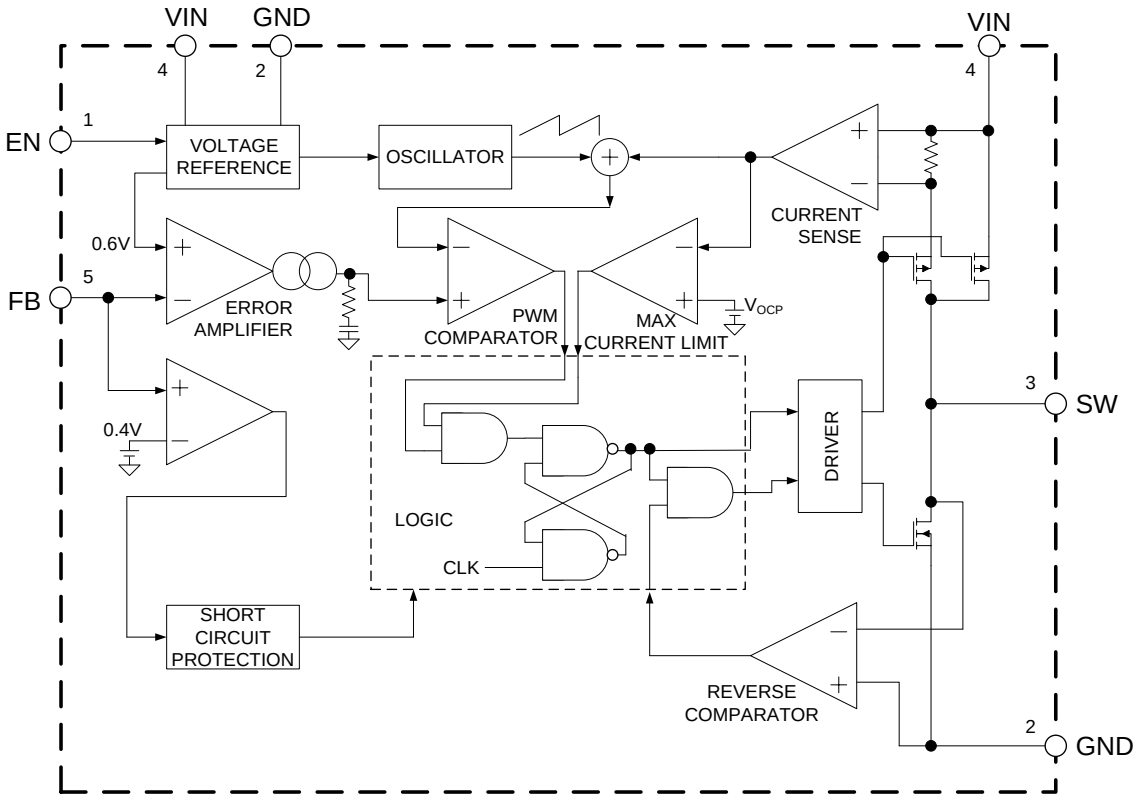
Typical Applications Circuit



Pin Descriptions

Pin Number	Pin Name	Function
1	EN	Control input pin. Forcing this pin above 1.5V enables the IC. Forcing this pin below 0.4V shuts down the IC. When the IC is in shutdown mode, all functions are disabled to decrease the supply current below 1μA
2	GND	Ground pin
3	SW	Power switch output pin. Inductor connection to drain of the internal PFET and NFET switches
4	VIN	Supply input pin. Bypass to GND with a 4.7μF or greater ceramic capacitor
5	FB	This is the feedback pin of the device. Connect this pin directly to the output if the fixed output voltage version is used. For the adjustable version, an external resistor divider is connected to this pin

Functional Block Diagram



Absolute Maximum Ratings (Note 4)

Symbol	Parameter	Rating	Unit
V_{IN}	Input Voltage	-0.3 to 6.0	V
V_{FB}	Feedback Voltage	-0.3 to V_{IN} +0.3	V
V_{EN}	EN Pin Voltage	-0.3 to V_{IN}+0.3	V
V_{SW}	SW Pin Voltage	-0.3 to V_{IN}+0.3 (Note 5)	V
θ_{JA}	Thermal Resistance	265	°C/W
T_J	Operating Junction Temperature	+150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
T_{LEAD}	Lead Temperature (Soldering, 10sec)	+260	°C
–	ESD(Machine Model)	200	V
–	ESD(Human Body Model)	2000	V

Notes: 4. Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

5. DC voltage rating, for short period of spike voltage, the minimum voltage rating is -1V, in 20nS.

Recommended Operating Conditions

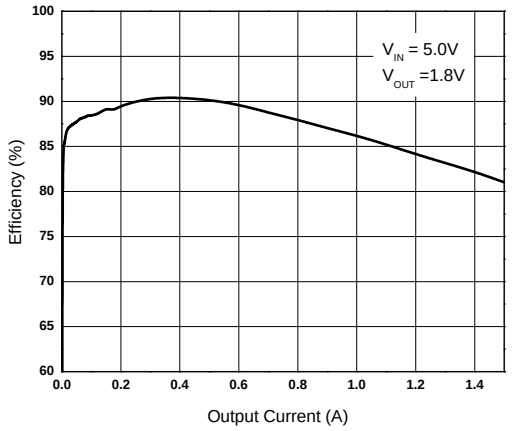
Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	2.5	5.5	V
T_A	Operating Ambient Temperature	-40	+85	°C

Electrical Characteristics (V_{IN} = 5V, T_A = +25ºC, unless otherwise specified.)

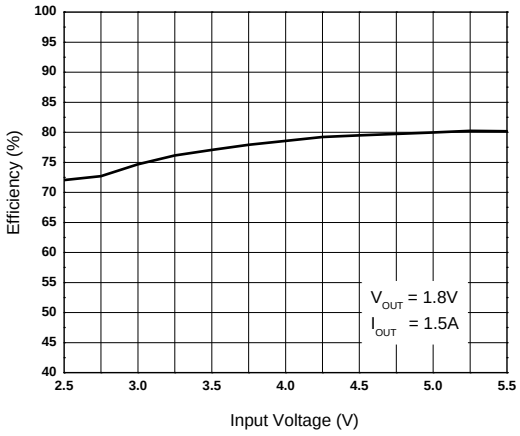
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage	–	2.5	–	5.5	V
I_Q	Quiescent Current	V_{FB} = 0.65V	–	62	100	μA
I_{STBY}	Shutdown Supply Current	V_{EN} = GND	–	0.1	1	μA
V_{REF}	Reference Voltage	For Adjustable Output Voltage	0.588	0.6	0.612	V
I_{FB_H}	Feedback Bias Current	V_{FB} = 1V	-0.1	–	0.1	μA
I_{FB_L}		V_{FB} = 0V	-0.1	–	0.1	
$R_{DS(ON)\_P}$	PMOSFET R_{ON}	I_{SW} = 200mA	–	0.2	–	Ω
$R_{DS(ON)\_N}$	NMOSFET R_{ON}	I_{SW} = -200mA	–	0.15	–	Ω
I_{LIM}	Switch Current Limit	V_{FB} = 0.55V	1.8	2.3	–	A
V_H	EN Pin Threshold	–	1.5	–	–	V
V_L		–	–	–	0.4	
V_{UVLO}	UVLO Threshold	V_{IN} Rising	–	2.3	–	V
V_{HYS}	UVLO Hysteresis	–	–	0.2	–	
f_{OSC}	Oscillator Frequency	–	1.12	1.40	1.68	MHz
D_{MAX}	Max. Duty Cycle	–	100	–	–	%
D_{MIN}	Min. Duty Cycle	–	–	–	0	
I_{SW_H}	SW Leakage Current	V_{SW} = 0V	–	0.1	–	μA
I_{SW_L}		V_{SW} = 5V	–	0.1	–	
t_{SS}	Soft-start Time	–	–	1	–	ms
T_{OTSD}	Thermal Shutdown	–	–	+160	–	ºC
T_{HYS}	Thermal Shutdown Hysteresis	–	–	+20	–	ºC

Performance Characteristics (V_{IN} = 5V, T_A = +25ºC, unless otherwise specified.)

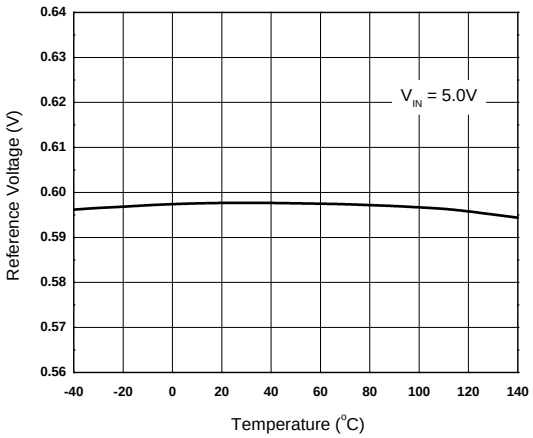
Efficiency vs. Output Current



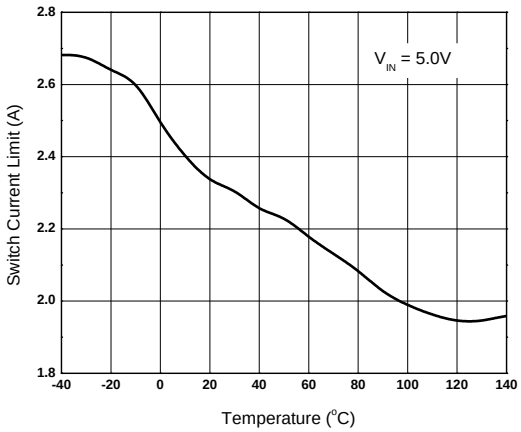
Efficiency vs. Input Voltage



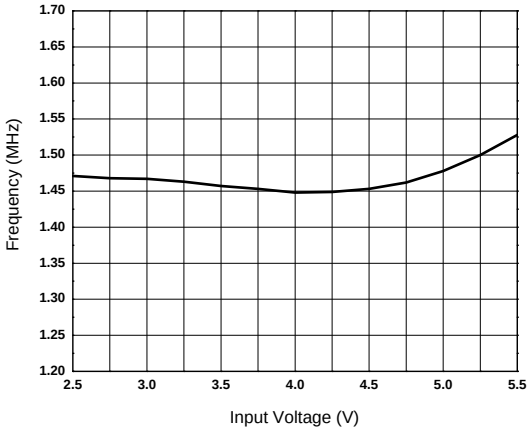
Reference Voltage vs. Temperature



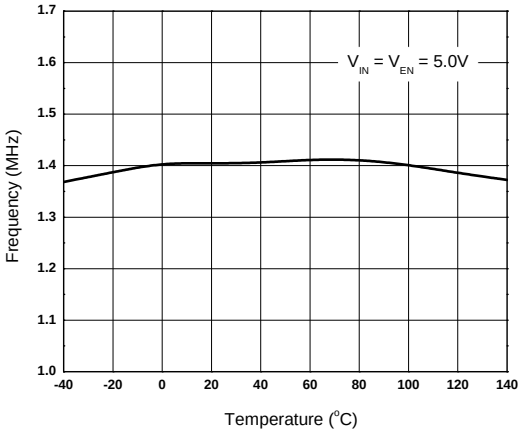
Switch Current Limit vs. Temperature



Frequency vs. Input Voltage

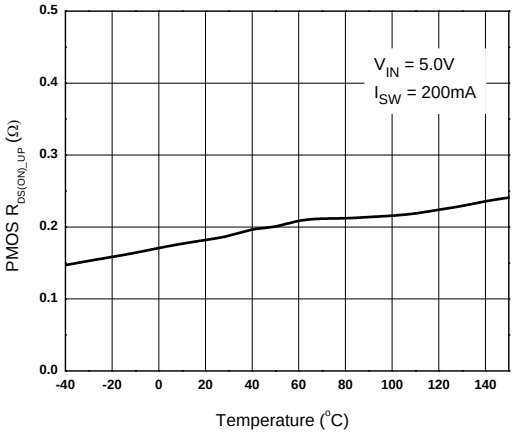


Frequency vs. Temperature

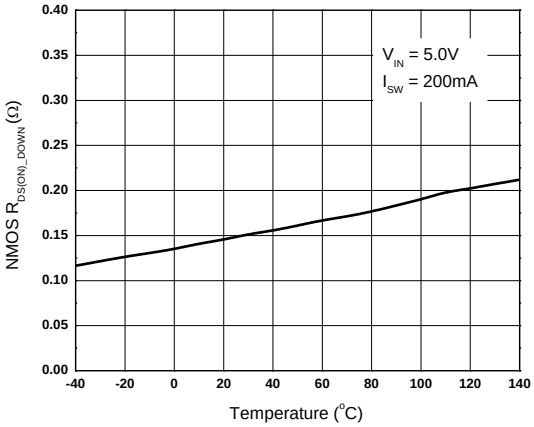


Performance Characteristics (Cont. V_{IN} = 5V, T_A = +25ºC, unless otherwise specified.)

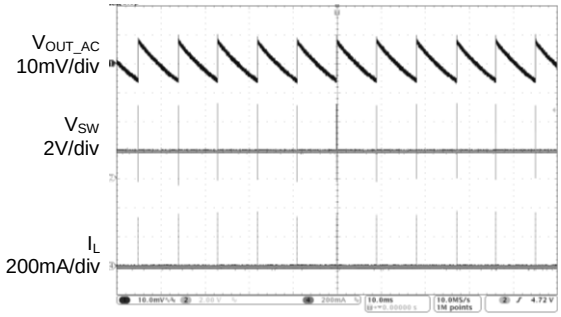
$R_{DS(ON)\_UP}$ vs. Temperature



$R_{DS(ON)\_DOWN}$ vs. Temperature

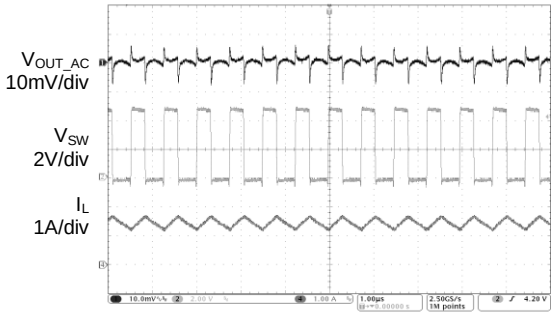


Output Ripple (I_{OUT} = 0A)



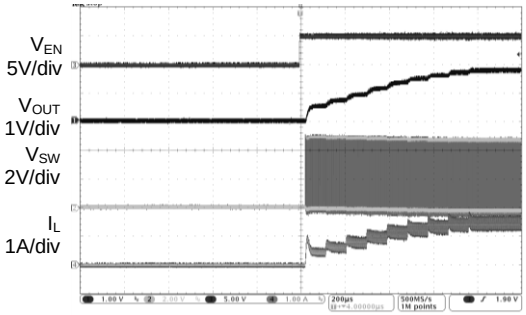
Time 10ms/div

Output Ripple (I_{OUT} = 1.5A)



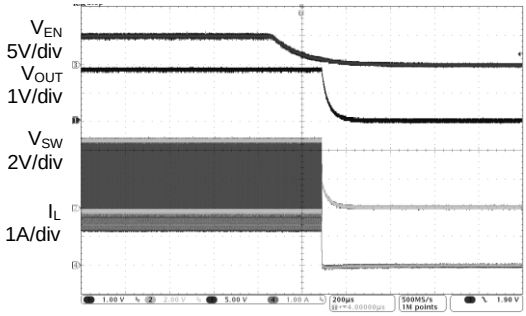
Time 1µs/div

Enable Turn on (I_{OUT} = 1.5A)



Time 200µs/div

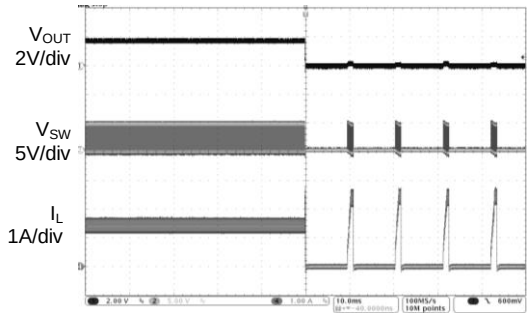
Enable Turn off (I_{OUT} = 1.5A)



Time 200µs/div

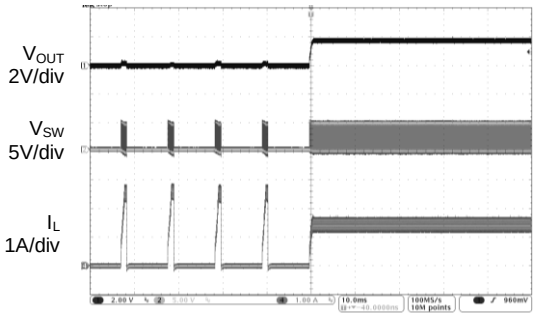
Performance Characteristics (Cont. V_{IN} = 5V, T_A = +25ºC, unless otherwise specified.)

Short Circuit Protection
(I_{OUT} = 1.5A)



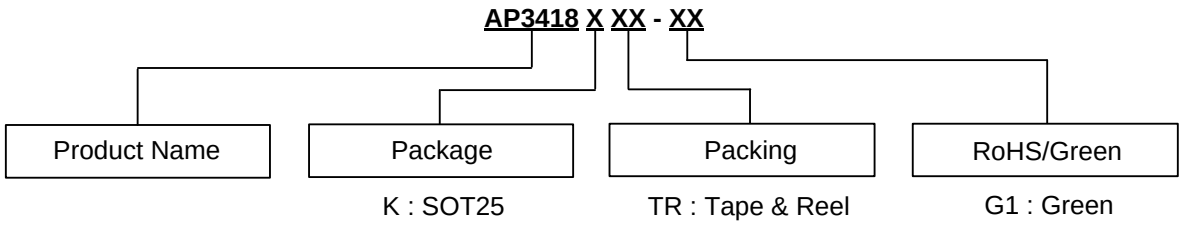
Time 10ms/div

Short Circuit Protection Recovery
(I_{OUT} = 1.5A)



Time 10ms/div

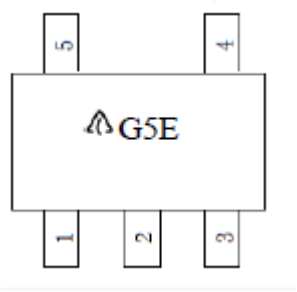
Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing
SOT25	-40 to +85 ºC	AP3418KTR-G1	G5E	3000/Tape & Reel

Marking Information

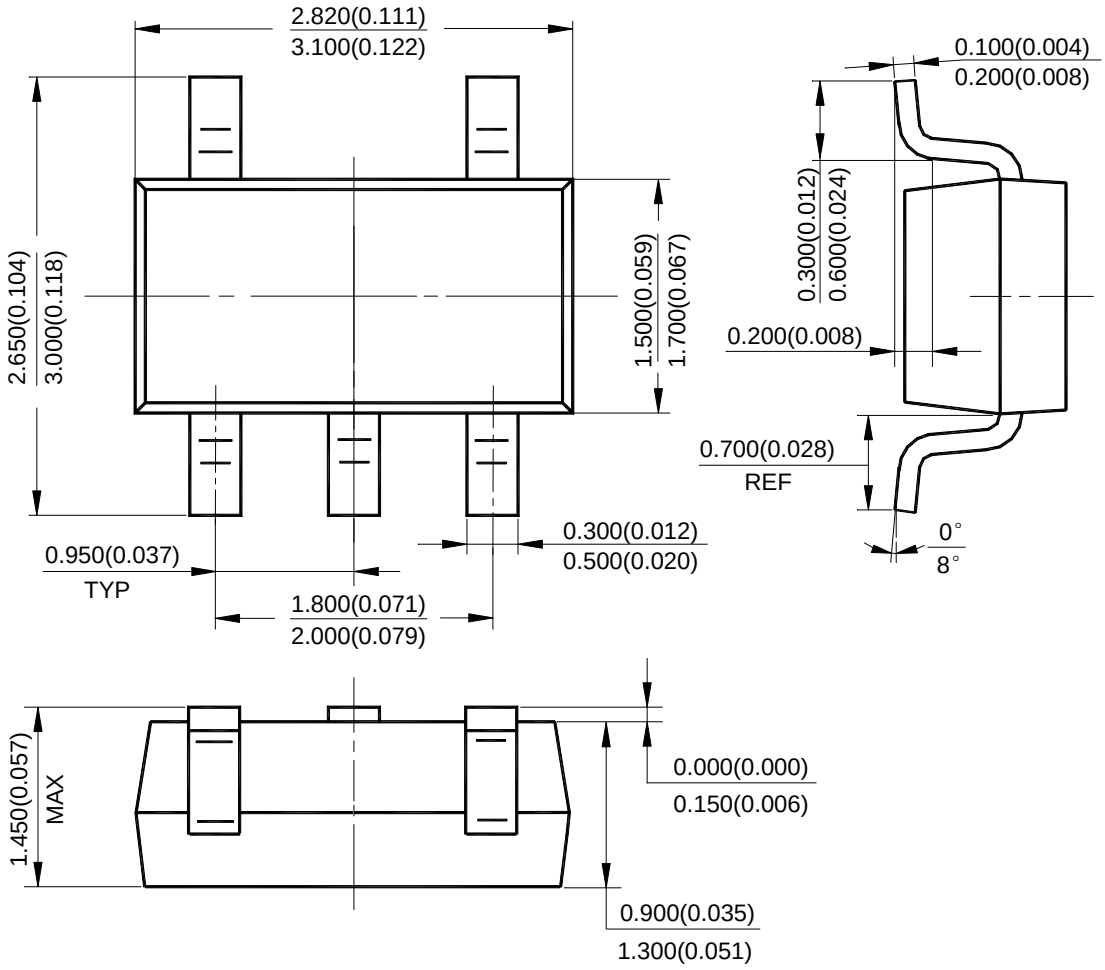
(Top View)



: Logo
G5E: Marking ID

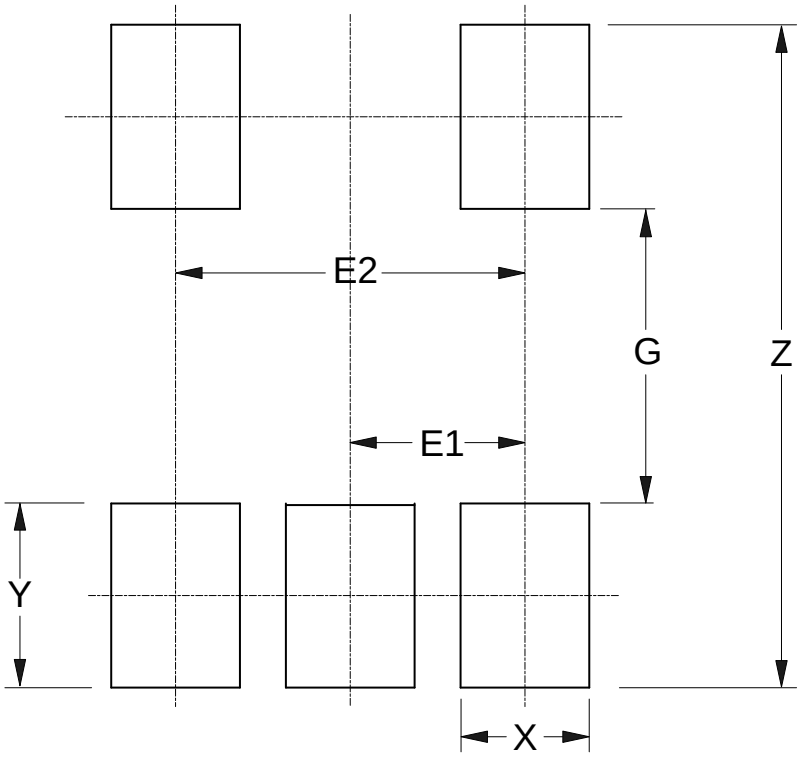
Package Outline Dimensions (All dimensions in mm(inch).)

(1) Package Type: SOT25



Suggested Pad Layout

(1) Package Type: SOT25



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E1 (mm)/(inch)	E2 (mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037	1.900/0.075

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